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# *Systems Engineering for Acquisition Managers*

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**937-781-1061**

- **Systems Engineering in DoD Acquisition**
- **Impact of Changes to DoDI 5000.02**
- **Proposed Changes from “Weapons Systems Acquisition Reform Act of 2009”**
- **SecDef 2010 Defense Budget**

# What is a System?

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**Is the following a  
picture of a  
Weapons System?**

# ***The F-16***





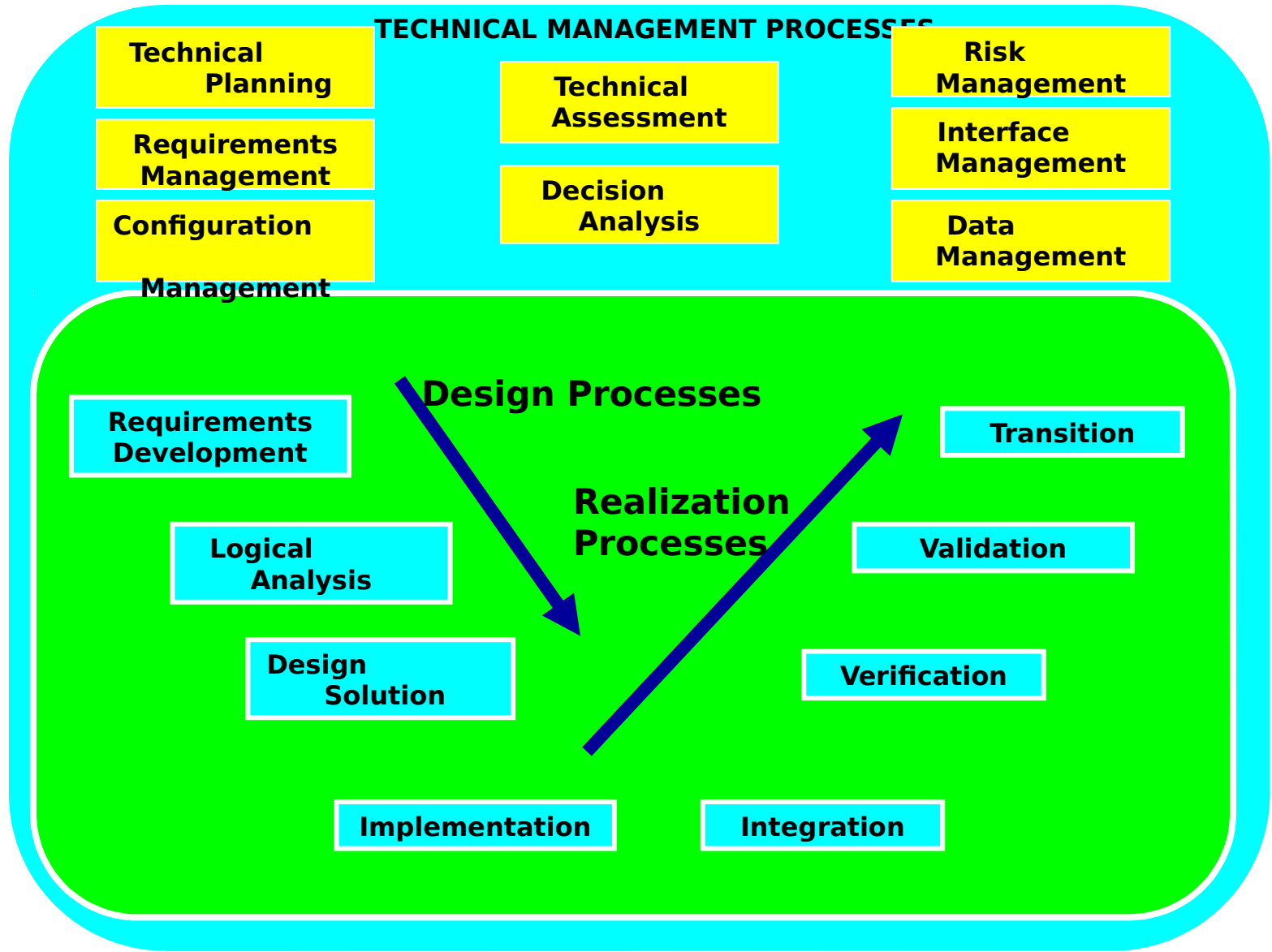


# Systems Engineering in DoD Acquisition

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- **Begins With Customer Needs**
- **Translated Into Technical Requirements**
- **Developed, Tested, Produced and Fielded**
- **Trace Back to Customer Needs**
- **Encompasses Multiple Disciplines**
- **Performed Throughout the Life Cycle**

# Systems Engineering Process Model

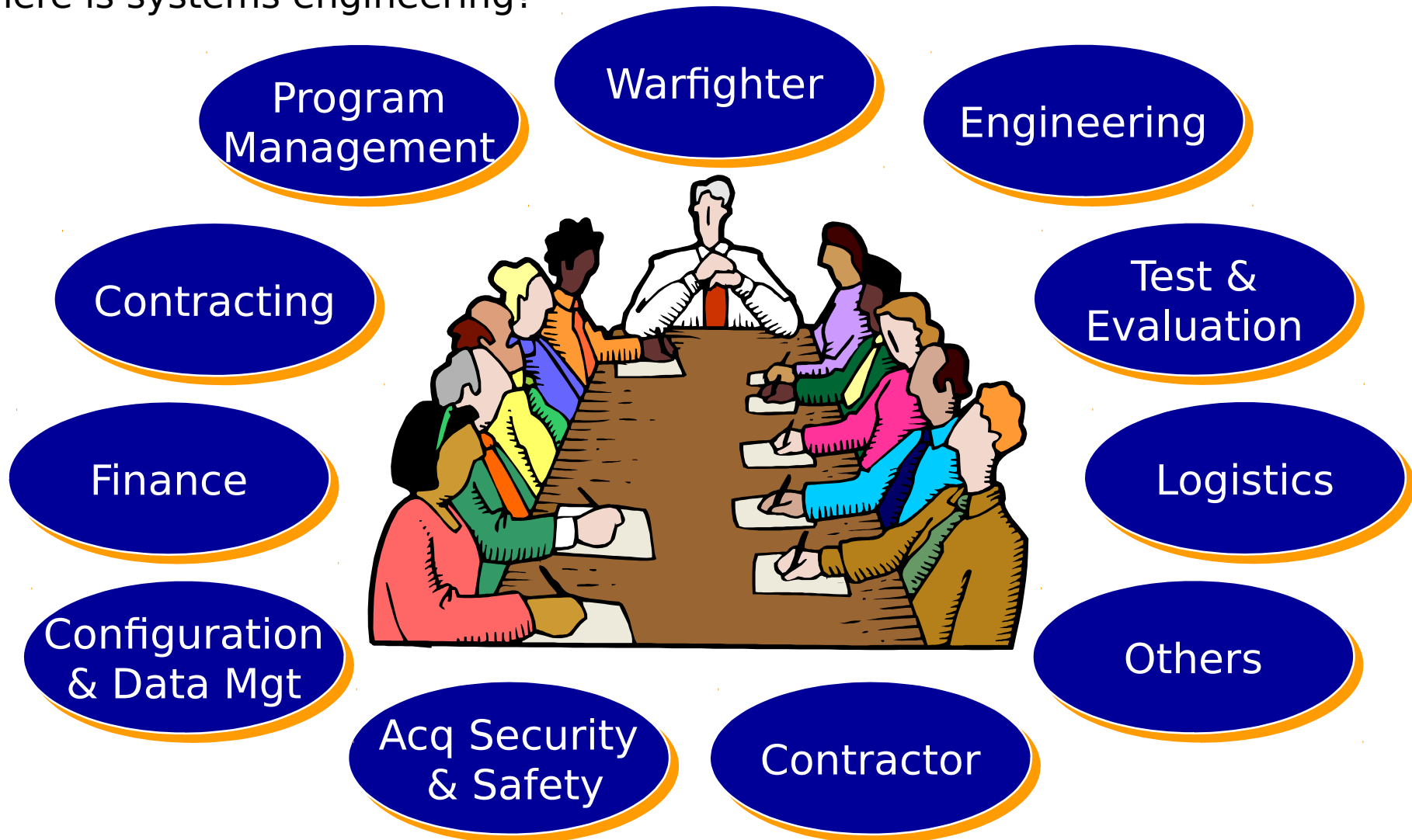






# Systems engineering cannot be applied without the support of other functionals!

Where is systems engineering?



# Impact of DoDI 5000.02 on Systems Engineering

# DoDI 5000.02 signed 2 DEC 08

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- DoDI 5000.2: 2003 vs. 2008
- New Policy Directed by Congress
- New or Revised Regulatory Policy
- Statutory & Regulatory Information & Milestone Requirements
- New/Revised Enclosures to DoDI 5000.02
- The Defense Acquisition Management System - Milestones, Phases and Key Activities

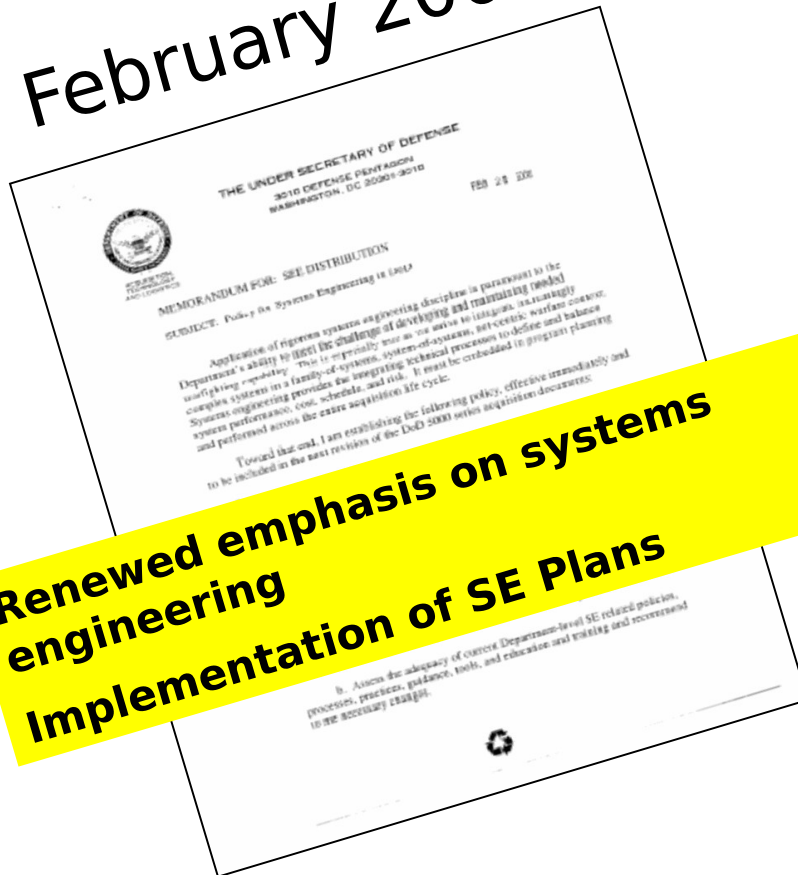
# Noteworthy Changes

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- Policy Flowing from Numerous New/Revised sections of Public Law since 2003 (some with Multiple Requirements)
- Approved Policy Appearing in over 25 Policy Memos and DoD Responses to the GAO, IG, and Congress
- Reference to 10 Updated or Newly Issued DoD Publications
- Consideration of Over 700 Defense Acquisition Policy Working Group

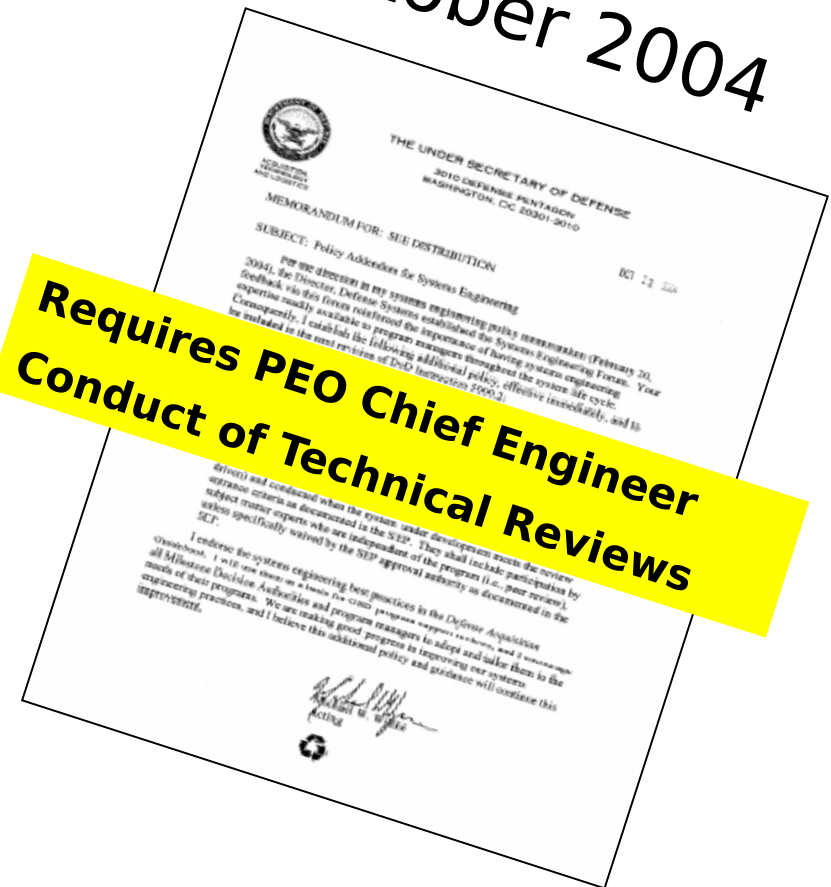
# SE Revitalization

February 2004



**Renewed emphasis on systems engineering**  
**Implementation of SE Plans**

October 2004

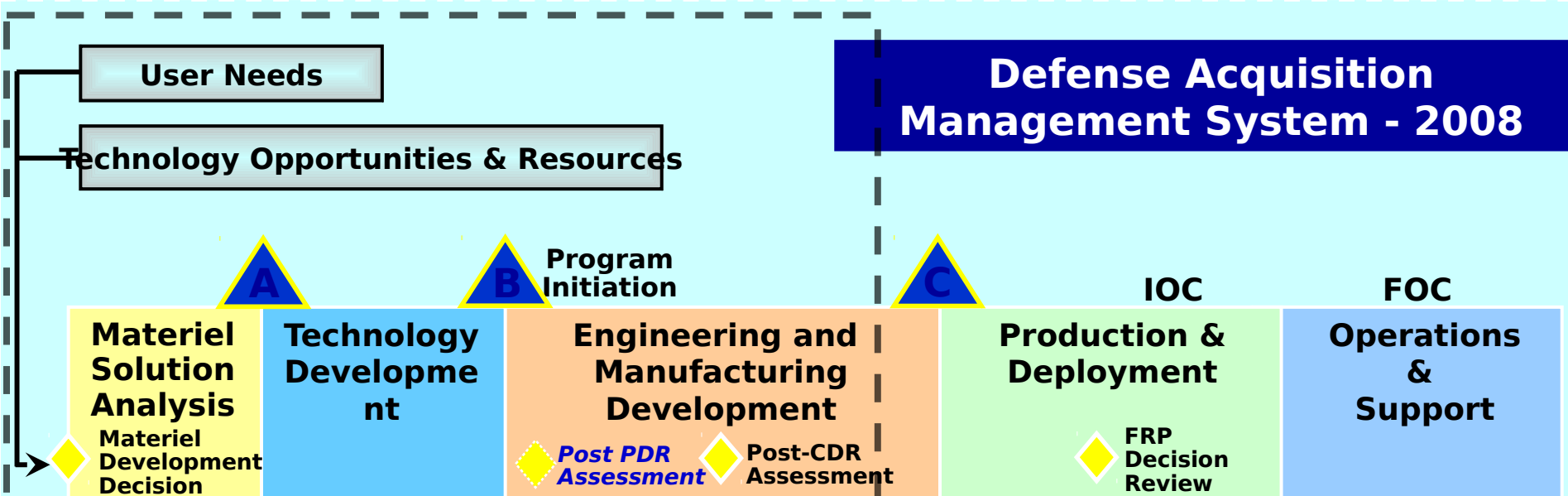
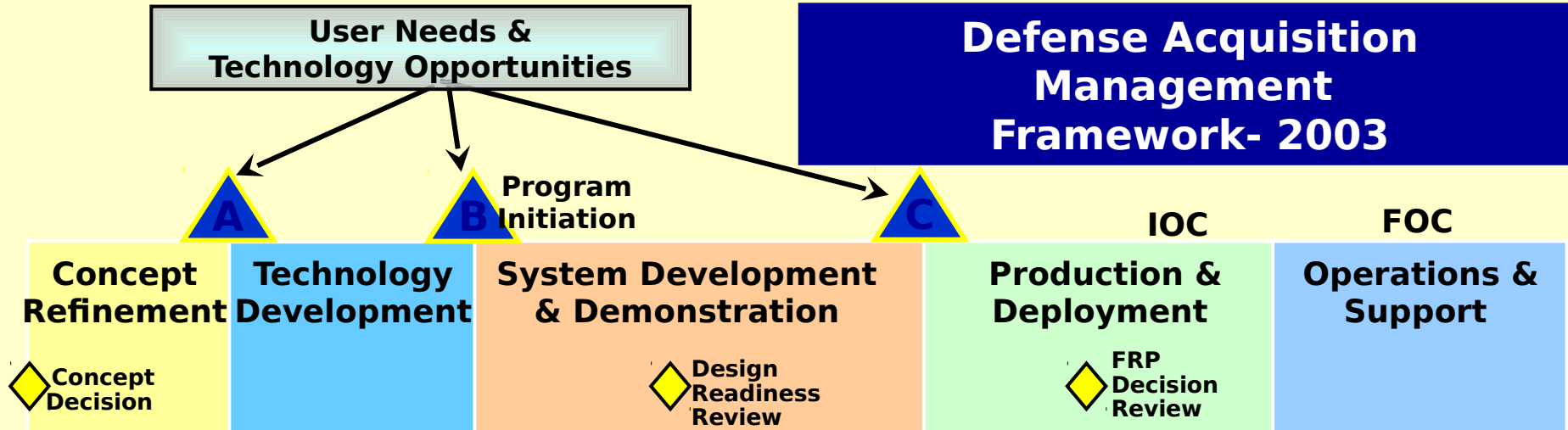


**Requires PEO Chief Engineer Conduct of Technical Reviews**

AT&L policy letters call for revitalization of Systems Engineering

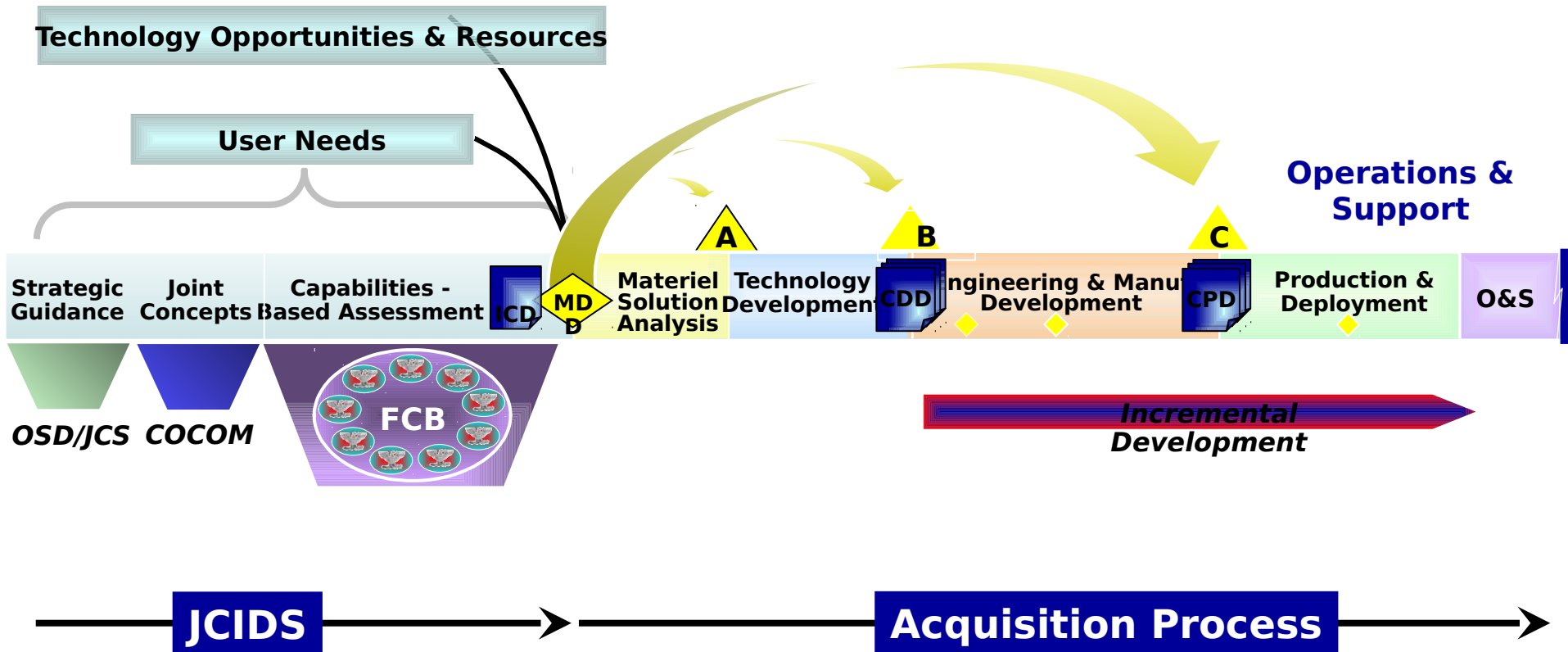


# Comparison of 2003 to 2008





# The Defense Acquisition Management System 2008

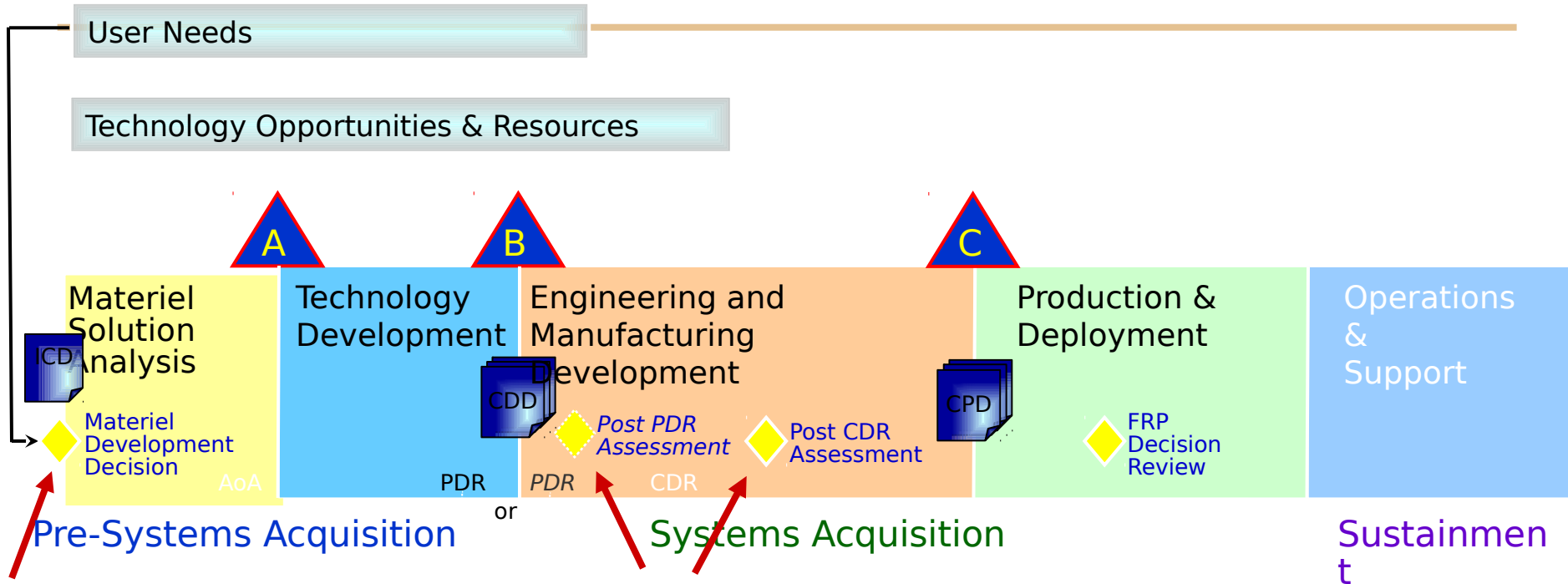


***“Following the Materiel Development Decision (MDD), the MDA may authorize entry into the acquisition management system at any point consistent with phase-specific entrance criteria and statutory requirements.”***



# The Defense Acquisition Management System

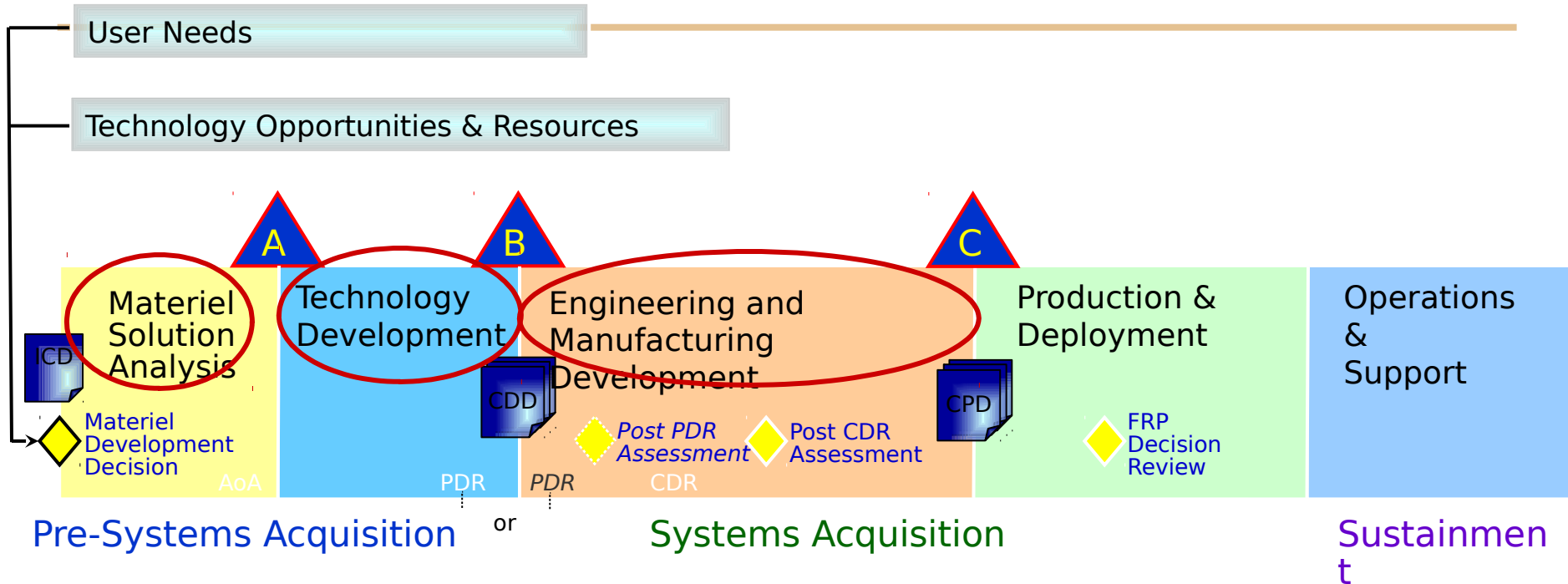
2008



## Changes to Decision Points

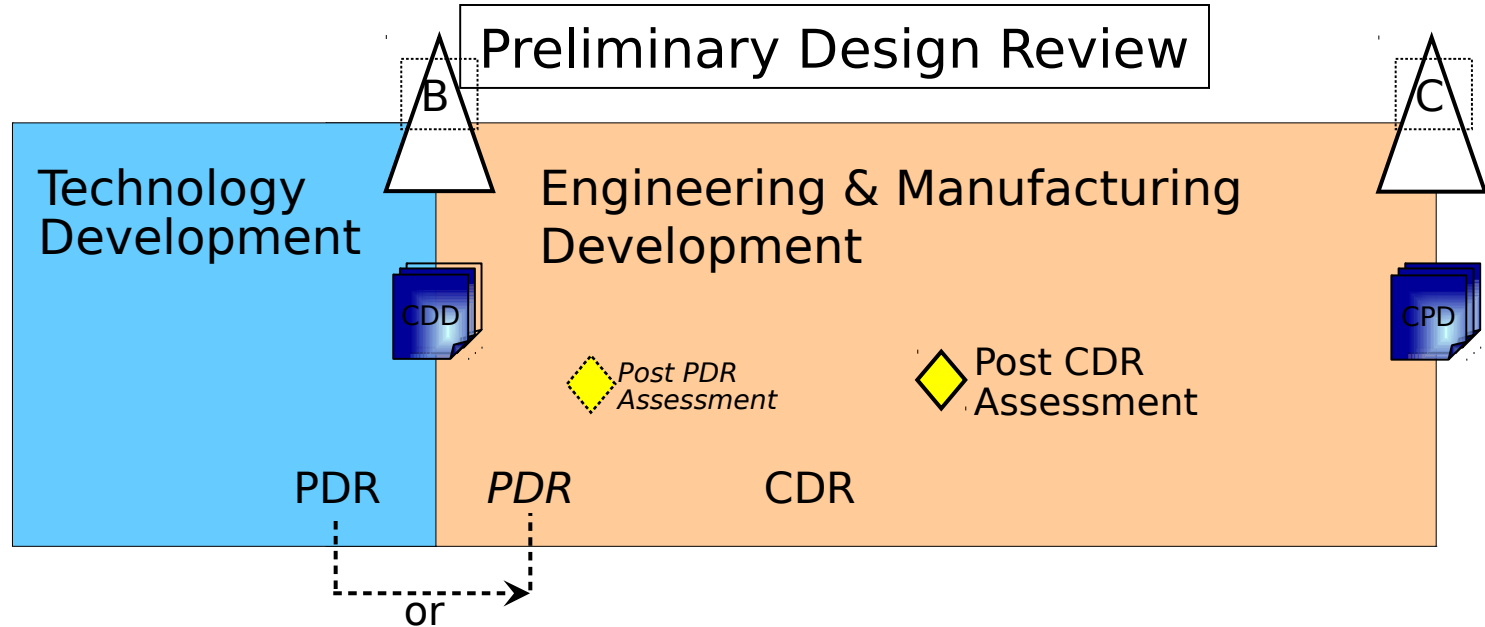
Old (2003)	New (2008)	Change from 2003
Concept Decision (CD)	Material Development Decision (MDD)	MDD required prior to entering the process at any point
N/A	Post-PDR Assessment	MDA's assessment of PM's PDR Report (if PDR after MS B)
Design Readiness Review DRR	Post-CDR Assessment	MDA's assessment of PM's CDR Report

# The Defense Acquisition Management System 2008



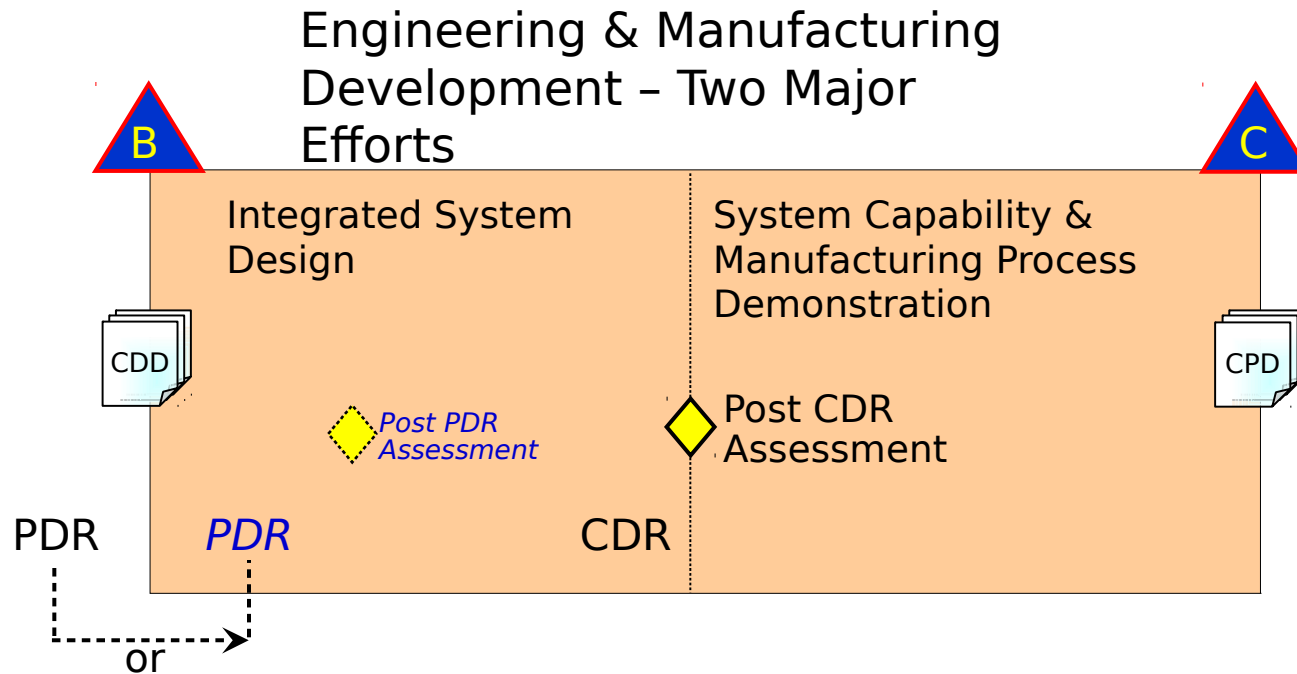
## Changes to Phases

Old (2003)	New (2008)	Change from 2003
Concept Refinement (CR)	Material Solution Analysis	More robust AoA (result of changes to JCIDS)
Technology Development (TD)		Competitive prototyping
Systems Development & Demonstration (SDD)	Engineering & Manufacturing Development (EMD)	More robust system engineering



PDR Before Milestone B	PDR After Milestone B
<ul style="list-style-type: none"> <li>Planned for in Technology Development Strategy</li> <li>PDR Report provided to MDA at MS B</li> <li>Includes recommended requirements trades</li> </ul>	<ul style="list-style-type: none"> <li>Planned for in Acquisition Strategy</li> <li>PDR Report provided to MDA prior to Post PDR Assessment</li> <li>Reflects requirements trades</li> <li>At Post PDR Assessment, MDA considers PDR report; determines action(s) required to achieve APB objectives and issues</li> </ul>

# The Defense Acquisition Management System

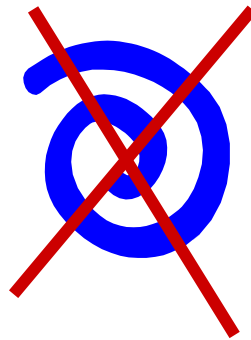


Old (2003)	New (2008)	Change from 2003
System Design	Integrated System Design	Establishment of Product Baseline for all Configuration Items
System Demonstration	System Capability & Manufacturing Process Demonstration	Manufacturing processes effectively demonstrated; production-representative article(s) demonstrated in intended environment; T&E assesses improvements to mission capability and operational support based on user needs.

# Evolutionary Acquisition

From two processes...  To one process...

- Incremental Development: End-state is known; requirements met over time in several increments
- Spiral Development: End-state is not known; requirements for increments dependent upon technology maturation and user feedback.



No spirals!

- Capability delivered in increments, recognizing up front need for future capability improvements
- Each increment:
  - depends on mature technology
  - is a militarily useful and supportable operational capability
  - Successive Technology Development Phases may be needed to mature technology for multiple increments

# Enclosures to DoDI 5000.02

1 References

**2 Procedures**

3 ACAT and MDA

4 Statutory and Regulatory Information and  
Milestone Requirements

} Tables  
Updated

**Table 5. EVM Implementation Policy**

**Table 6. APB Policy**

**Table 7. Unique Decision Forums**

5 IT Considerations

6 Integrated T&E

7 Resource Estimation

8 Human Systems Integration

9 Acquisition of Services

10 Program Management

**11 Management of Defense Business Systems**

**12 Systems Engineering**

- **Systems Engineering Plan (SEP) required at each milestone**
- **MDA is approval authority for the SEP**
- **For programs where USD(AT&L) is MDA, and programs on the DT-only portion of OSD T&E Oversight List, SEPs must be submitted to Director, Systems and Software Engineering 30 days prior to DAB/ITAB review**
- **PEOs must have lead systems engineer - oversees SE across PEOs portfolio; reviews SEPs; assesses performance of subordinate systems engineers with PEO and PM**
- **Event-driven technical reviews required - with SMEs independent of program, unless waived by MDA**
- **Requires configuration management to establish and control product attributes and the technical baseline**

- **ESOH risk management required to be integrated with overall SE process; Programmatic ESOH Evaluation (PESHE) required of all programs regardless of ACAT**
- **NEPA and EO 12114 (Environmental Effects Abroad of Major Federal Actions) analysis required of PM, approved by CAE**
- **Addresses PM support of Mishap Accident Investigations**
- **Requires Corrosion Prevention Control Plan for ACAT I programs at MS B and C**
- **Requires PMs to employ modular open systems approach to design**
- **Data Management Strategy (DMS) required to assess long-term technical data needs of the system - included in Acquisition Strategy**



# Proposed Changes from “Weapons Systems Acquisition Reform Act of 2009”

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What is it?: A Bill introduced by Sen Levin and Sen McCain “To Improve the organization and procedures of the Department of Defense for the Acquisition of major weapon systems, and for other purposes.”

“The key to successful acquisition programs is getting things right from the start with **sound systems engineering, cost-estimating, and developmental testing early in the program cycle**. Programs that are built on a weak initial foundation, including **immature technologies, inadequate development and testing, and unrealistic requirements**, are likely to have big problems in the long run.”



# Summary of the Bill

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## **Title 1: Acquisition Organization.**

**Section 101. Systems Engineering Capabilities.** Will require DOD to:

- (1) Assess the extent to which the Department has in place the systems engineering capabilities needed to ensure that key acquisition decisions are supported by a rigorous systems analysis and systems engineering process;
- and (2) establish organizations and develop skilled employees needed to fill any gaps in such capabilities.

**Section 102. Developmental Testing.** Will require DOD to reestablish the position of Director of Developmental Test and Evaluation; and (2) require the military departments to assess their developmental testing

**Section 103. Technological Maturity Assessments.** The Director of Defense Research and Engineering (DDR&E) will have responsibility to periodically review and assess the technological maturity of critical technologies used in MDAPs.

**Section 104. Independent Cost Assessment.** Will establish a Director of Independent Cost Assessment to ensure that cost estimates for MDAPs  
Are fair, reliable, and unbiased.

**Section 105. Role of Combatant Commanders.** Requires the JROC to seek and consider input from the commanders of the combatant commands  
In identifying joint military requirements.

## **Title 2: Acquisition Policy**

### **Section 201. Trade-offs of Cost, Schedule and Performance.**

Will require

Consultation between the budget, requirements and acquisition stovepipes—

Including consultation in the joint requirements process– to ensure the consideration of trade-offs between cost, schedule, and performance early in

The process of developing major weapon systems.

**Section 202. Preliminary Design Review (PDR).** Requires the completion of a

PDR and a formal post-PDR assessment before an MDAP receives Milestone B approval.

**Section 203. Life-Cycle Competition.** Recommends implementing measures – such as competitive prototyping, dual-sourcing, funding of a second source for next generation technology, utilization of open architectures to ensure competition for upgrades, periodic competitions for subsystem upgrades, licensing of additional suppliers,

**Section 204. Nunn-McCurdy Breaches.** Would enhance the use of Nunn-McCurdy by requiring MDAPs that experience critical cost growth: (1) be terminated unless the Secretary certifies (with reasons and supporting documentation) that continuing the program is essential to the national security, and can be modified to proceed in a cost-effective manner; and (2) receive a new Milestone Approval prior to the award of any new contract or contract mod to extend the scope of the program.

**Section 205. Organizational Conflicts of Interest.** Would (1) prohibit systems engineering contractors from participating in the development or construction or the major weapon systems on which they are advising the DoD; and (2) require tightened oversight of organizational conflicts of interest by contractors.

**Section 206. Acquisition Excellence.** Establish an annual awards program to recognize individuals and teams who make significant contributions to the improved cost, schedule, and performance of defense acquisition programs.

## **Three principle objectives:**

- To reaffirm commitment to take care of the all-volunteer force.
- To rebalance the department's programs in order to institutionalize and enhance capabilities to fight the wars of today and the scenarios we are most likely to face in the years ahead.
- Reform how and what we buy, meaning a fundamental overhaul of our approach to procurement, acquisition, and contracting.
  - Increase size of Defense Acquisition Workforce, converting 11,000 contractors and hiring an additional 9,000 govt acq professionals by 2015.
  - Seeks greater funding flexibility and the ability to streamline requirements and acquisition execution procedures.

# Summary

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- The “Best of Times, the Worst of Times” for Systems Engineering.
- Major changes to DoDI 5000.02. Operation of the Defense Acquisition System.
- New legislation in the form of “Weapons System Acquisition Reform Act of 2009”
- Secretary of Defense engaged to bring about change.
- People recognized as America’s greatest strategic asset.

# BACK UPS



- Military Equipment Valuation  
(accounting for military equipment)
- MDA Certification at Milestones A & B
- Cost type contract for EMD  
Phase requires written determination by MDA
- Lead Systems Integrator Restrictions

- New MAIS Reporting Requirements
- “Time-Certain” IT Business Systems Development
- Defense Business Systems Oversight
- MDA assessment of compliance with chemical, biological, radiological, and nuclear survivability (CBRN) requirements at Milestones B and C

- Detailed Acquisition of Services Policy
- Independent management reviews (Peer Reviews) for supplies and services contracts
- Interim Beyond LRIP Report
- DOT&E's Role in Testing Force Protection Equipment / Non-Lethal Weapons
- Nunn McCurdy breach / APB

# New or Revised Regulatory Policy

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- Detailed Systems Engineering Policy
- Program Support Reviews (PSRs)
- Integrated Test & Evaluation
- Restricted use of performance requirements that do not support KPPs
- Comparison with current mission capabilities during OT&E
- Assessment of Operational Test Readiness (AOTR)
- Life-Cycle Sustainment Plan (LCSP)
- Cost of energy in AoA and resource

- Contract Incentives Strategy
- Contracting for Operational Support Services
- Approval of Technology Development Strategy prior to Release of final RFP for Technology Development Phase
- Approval of Acquisition Strategy prior to release of final RFP for EMD or any succeeding phase.
- Reliability, Availability, and Maintainability (RAM) strategy
- Data Management Strategy

# **Manufacturing Readiness Assessments**

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- **Purpose**

- **Used to assess our readiness for manufacturing**
- **Uses Manufacturing Readiness Levels (MRLs) Modeled after TRL's**
- **10 levels of readiness assessing 9 area / functional "threads."**
- **Manufacturing Readiness Assessment Guide**

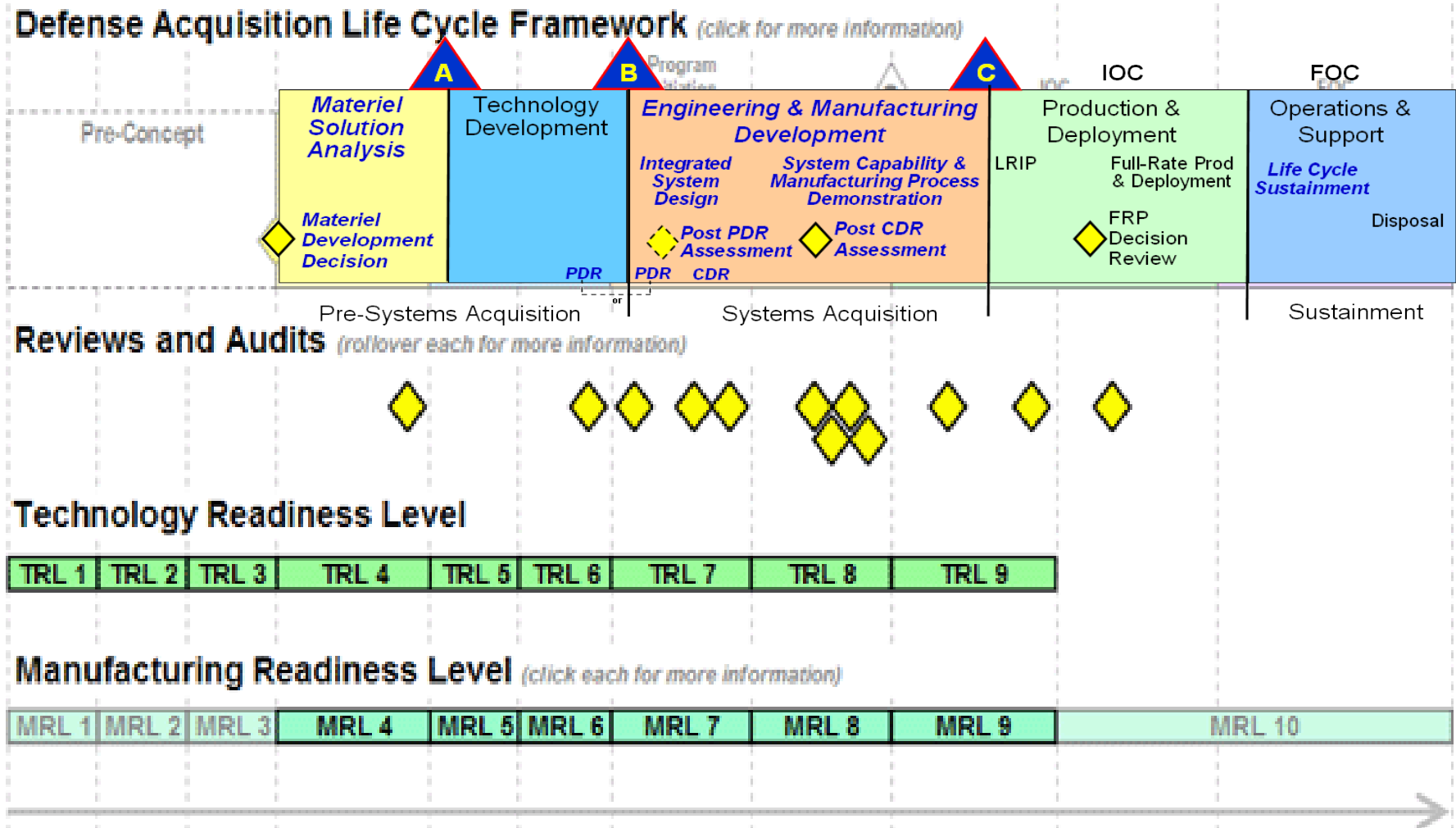
- **Benefits**

- **Identification of Production Risks**
- **Program Risk Management Plan Updated**
- **Development of Risk Mitigation Plans**
- **Implementation of Manufacturing Planning and Process Improvement Activities**

# MRL Levels & Definitions

MRL	Definition	Description	Phase
1-3	Manufacturing concepts Identified	Identification of current manufacturing concepts or producibility needs based on laboratory studies. Assumed that all corresponding TRL requirements are met for each MRL below.	Pre Concept Refinement
4	Manufacturing capability to produce the system ... lab env.	Conceptual design completed. Requirement validation underway. MANTECH identified. ....Key technologies TRL 4.	Con. Refinement
5	Manufacturing capability to produce...in an initial production representative environment.	Manufacturing requirements preliminarily defined and validated. .... Producibility assessments ongoing. DTC cost drivers identified.	Tech. Development
6	Manufacturing capability to produce ...in a production-representative environment.	Majority of manufacturing requirements preliminarily defined. Significant engineering/design changes. Preliminary design of critical components completed. .... Long lead needs and key supply chain elements identified.	TD - MS B decision.
7	Manufacturing capability maturing to produce ... in a low rate initial production.	Engineering/design changes decreasing. Physical and functional interfaces clearly defined. All raw materials are fully understood..... System transitioned to formal configuration control. Long lead readiness plans in place.	SDD / DRR
8	Manufacturing capability in place to begin low rate initial production.	Design sufficiently stable to enter into low rate initial production. Physical and functional interfaces clearly defined. .... Key technologies at least at TRL 8.	SDD - MS C
9	Manufacturing capability in place to begin full rate production.	During LRIP all systems engineering/design requirements are met and there are only minimal system engineering/design changes. .... Production risk monitoring is ongoing. LRIP actual costs meet estimates	P&D - FRP
10	Manufacturing capability in place to achieve lean production.	This is the highest level of production readiness. .... A proven, affordable product able to meet required schedule. Production actual costs meet estimates	FRP Sustainment

# Life Cycle TRL / MRL Comparison



**Screen Capture of Acquisition Community Connection**  
<https://acc.dau.mil/CommunityBrowser.aspx?id=18231>